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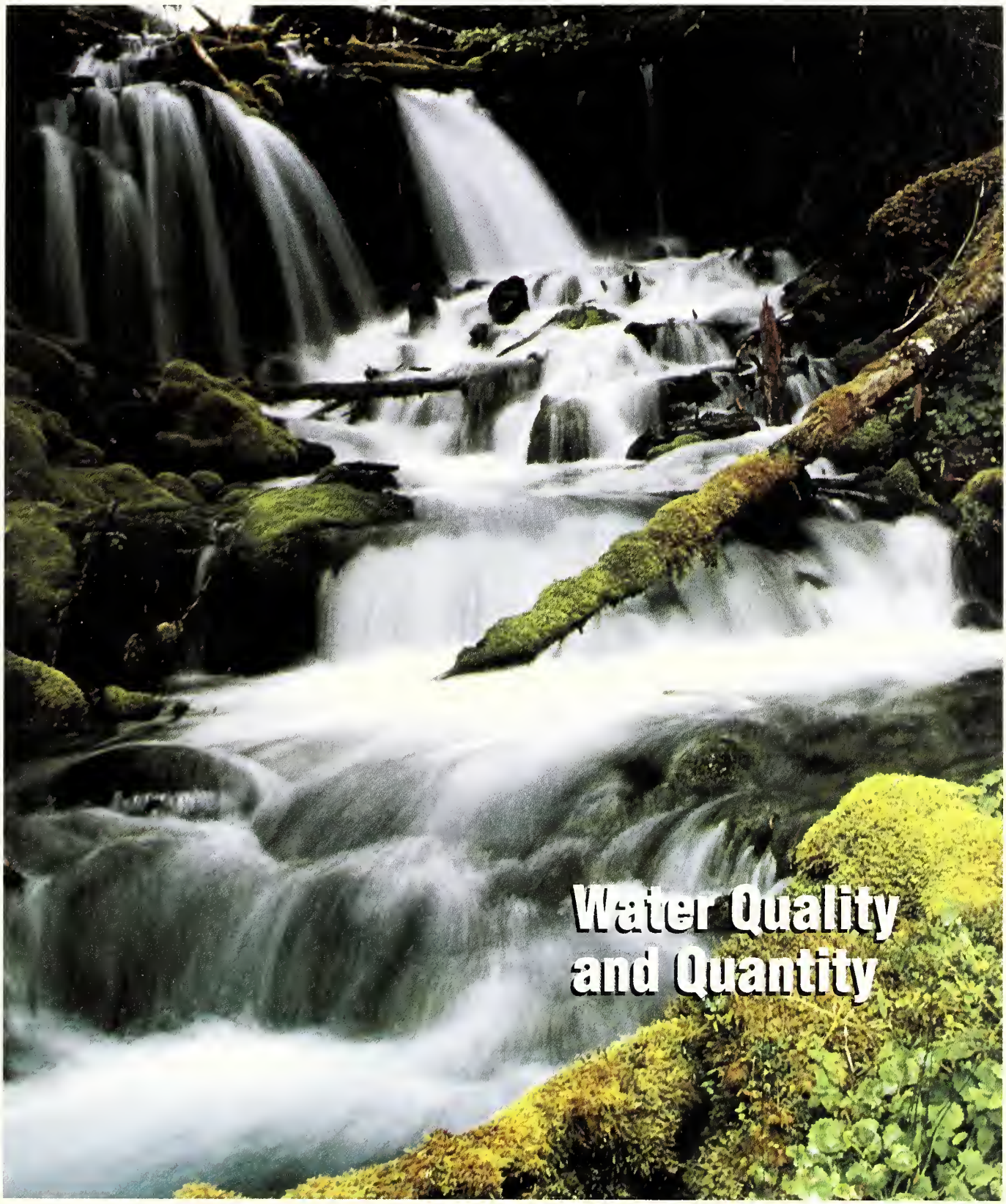

Cover: Care of America's water begins upstream. As it flows down the watershed, its quality and quantity are affected by the uses Americans make of it. The Soil Conservation Service is helping farmers and ranchers do their part to maintain water quality.

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Comments from the SCS Chief:

Water Quality Is Everyone's Responsibility

America's farmers and ranchers recognize that water quality is everyone's responsibility—rural and urban. But, people working in agriculture have a special responsibility.

The President's Water Quality Initiative, begun in 1989, calls for voluntary cooperation in improving water quality. Farmers and ranchers have every reason to cooperate. They know that farm nutrients and pesticides find their way into ground water, which provides 95 percent of the drinking water in rural areas. It's in their own best interest to keep their family's water supply as pure as possible.

One way to accomplish this is to closely monitor application of nutrients and pesticides. Adopting conservation practices, animal waste management, and new methods in water management can cut down on runoff and the percolation of pollutants through the soil. Local Soil Conservation Service offices can provide information and technical assistance available to help farmers find the best practices for their individual situations. SCS field office people have the expertise and the experience, and know what works.

Financial assistance is often available from several sources, such as cost-share funds from the Agricultural Stabilization and Conservation Service and from State water quality initiatives. Cutting down on nutrient and pesticide use can also save money for the farmer.

To increase awareness of water quality concerns and promote solutions, SCS has begun implementing a water quality and quantity communications action plan. Announcements and articles in the media, informational fact sheets, audiovisual material, and direct contact with farmers are underway. A checklist to assess potential for water quality improvement is planned, along with a video to lead the farmer through the list step by step.

Coordination between agencies and organizations at all levels is essential to an effective program for reducing nonpoint source pollution. Eleven USDA agencies are involved in the water quality initiative, and SCS recently signed an agreement with the Agricultural Stabilization and Conservation Service (ASCS) and the Extension Service (ES) to address water quality concerns. ASCS will furnish financial assistance, ES will conduct educational efforts, and SCS will provide technical assistance.

Other major water quality initiatives have already begun. USDA water quality demonstration projects will accelerate transfer and adoption of innovative technology. Hydrologic unit projects will tackle nonpoint source pollution within a watershed or aquifer recharge area. Special projects will accelerate implementation of water quality practices.

The National Association of Conservation Districts advocates a special water quality role for soil conservation districts in information, demonstrations, education, and implementation. Some local conservation districts have set up demonstration plots and farms to encourage use of best management practices.

SCS looks forward to working with farmers and ranchers and with State and local governments, other Federal agencies, and the private sector. We will continue our partnerships with these agencies and organizations in this initiative to protect the country's water supply.

Acting Chief

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Overview

USDA Plans For Water Quality Improvement

DEMONSTRATION farms...on-farm assistance...multistate projects—they're all part of an ever-growing effort by the U.S. Department of Agriculture to help farmers and ranchers tackle water quality concerns.

"We firmly believe that these concerns can best be addressed by voluntary action in the agricultural community," said Secretary of Agriculture Clayton Yeutter. "We're striving to get the best information to the farmer and rancher as fast as possible."

To do that, USDA is concentrating on three areas: education and technical assistance, research and development, and data base development.

Eight USDA agencies have lead roles and are working closely with other Federal and State agencies. Three of these are focusing on education and technical assistance to improve ground and surface water. They share leadership for hydrologic unit area, demonstration, and water quality special projects.

The Soil Conservation Service and the Extension Service are already providing joint leadership for 8 demonstration projects and 37 hydrologic unit areas. USDA's water quality initiative calls for a total of 24 demonstration projects by 1993, each continuing for 5 years, and up to 275 hydrologic unit areas by 1994, each continuing for 3 to 5 years.

USDA's Agricultural Stabilization and Conservation Service has 40 water quality special projects underway.

Within SCS, under the President's Initiative to enhance water quality, funding for water quality is $26.5 million for fiscal year 1990, more than double the previous year. The President's proposal for SCS for water quality is $44.1 million for fiscal year 1991. These funds are for demonstration projects, hydrologic unit areas, regional projects, technology and data base development, and ongoing water quality activities.

Agriculture-related, nonpoint source pollution problems are site-specific and complex to understand and manage. Because solving them involves numerous agencies at the Federal and State level, USDA has promoted coordination and cooperation from the outset.

A Water Quality Working Group, made up of all appropriate USDA agencies and other Federal agencies, provides leadership to share information and resources, cooperate in joint efforts, and foster a more uniform policy of abating agricultural nonpoint sources of pollution.

In support of USDA's water quality initiative, SCS has developed and is implementing a 5-year water quality plan, with four major goals:

- Increase technical assistance in areas with concerns about water quality and quantity, and demonstrate available technology that will protect or improve water quality;
- Help State water quality management agencies and soil and water conservation agencies develop and implement nonpoint source pollution-management programs (required by Section 319 of the Water Quality Act of 1987) for managing nonpoint source pollution;
- Evaluate pollutant loads to determine the level or contribution from agricultural sources relative to other sources; and
- Develop and recommend conservation systems or practices to reduce or prevent agricultural nonpoint source pollution.

In addition, conservation districts are taking an increasingly important role in water quality—providing local coordination essential to the success of water quality efforts.

Diana Morse, public affairs specialist, SCS, Washington, D.C.

A citizens' committee that includes staff from six county land conservation departments is part of the team...

Teamwork Cleans the Milwaukee River

THE SOIL Conservation Service is one of many groups and agencies in Wisconsin working as a team to improve water quality in the Milwaukee River Basin.

The Milwaukee River Priority Watersheds Program is part of the State nonpoint source program. Wisconsin's Department of Natural Resources and Department of Agriculture, Trade, and Consumer Protection are leading the effort to help landowners and local governments accomplish and fund this voluntary river cleanup. Nearly $30 million are available.

SCS provides technical assistance and training to county watershed staffs.

"We're focusing SCS efforts on training local staffs and on quality control," said Ted Manning, area conservationist in Beaver Dam, Wis. "Our SCS area staff assists the watershed staff in developing resource management plans to reach watershed objectives."

"SCS State, area, and field office staffs participate in advisory committees for the six subwatersheds," added Manning.

A citizens' committee that includes staff from six county land conservation departments is part of the team and works with the State's natural resource and agriculture departments to identify cleanup activities.

Planned solutions are being implemented in urban areas by local units of government, in rural areas by county land conservation departments, and in villages by city and village governments.

"In dealing with barnyard runoff, cropland erosion, and streambank repair, we encourage farmers to install traditional conservation practices," explained Carolyn Johnson, urban water quality educator at the University of Wisconsin-Extension in Milwaukee. "Cost-share monies are available for these practices.

Landowners and local government will help improve water quality in the Milwaukee River Basin, a State-funded watershed program. (Photo by Carolyn Johnson.)

What's Polluting The Milwaukee?

Despite 20 years of cleanup efforts, citizens surveyed in 1989 felt industry still caused most water quality problems in the Milwaukee River Basin. The real culprit, nonpoint source pollution, was caused by:

- Sediment from construction sites, cropland, and streambanks.
- Chemicals and nutrients from cropland.
- Toxic wastes from streets and parking lots.
- Nutrients and bacteria from barnyards.
- Grass, leaves, fertilizers, and pesticides from lawns, gardens, and recreational areas.
- Inadequately treated wastes from malfunctioning septic systems and holding tanks.

"In urban areas, soil erosion at construction sites accounts for 60 percent of the sediment load in the Menomonee and Milwaukee South watersheds near Milwaukee. Cropland only causes 10 to 15 percent."

Johnson said that half the municipalities in these watersheds have adopted construction erosion control ordinances. She described public information and education efforts that are encouraging citizens to act responsibly and to work together to keep pollutants out of the Milwaukee River.

Marjorie Christie, regional information officer, Midwest National Technical Center, SCS, Lincoln, Neb.

"...[this] is the first constructed wetland...that filters a catfish pond," said Ronnie Thomas..."This could revolutionize the catfish industry in Mississippi."

Plants Filter Mississippi Fish Pond

NASA SPACE research, which gave us Velcro and the microwave oven, is now improving water quality and catfish production in Mississippi.

Research on wastewater treatment for long-term space travel uses plant roots as a filter. Now several towns in Mississippi and catfish farmer Truman Roberts have adapted this research to their needs.

To replace its sewage plant, the town of Collins, Miss., constructed a relatively inexpensive wetland of living plants to filter the effluent. The filtered water, without added chemicals, safely discharges into a river used for canoeing.

Roberts, a Forrest County Soil and Water Conservation District commissioner, wondered why nutrients and waste from his catfish ponds couldn't be similarly filtered. So he discussed pond filtering with NASA's Bill Wolverton and with Ken Blan, Soil Conservation Service's liaison to the Gulf of Mexico Program.

"The growing number of catfish ponds in Mississippi and the excessive nutrient enrichment in Gulf waters are related," said Blan. "Recirculating catfish pond water through a constructed wetland can reduce nutrient and organic discharges into streams and, ultimately, the Gulf."

Conventional catfish pond outlets deliver nutrient-rich water to streams, bayous, and the Gulf of Mexico. There are nearly 100,000 acres of catfish ponds in the State—most of them in the Mississippi Delta. The potential to reduce wastewater discharge from catfish ponds is enormous.

"As far as I know, Roberts' is the first constructed wetland in the United States that filters a catfish pond," said Ronnie Thomas, SCS area wildlife biologist in Hattiesburg, who helped Charles Slocum, SCS area engineer, design the pond filter system. "This could revolutionize the catfish industry in Mississippi."

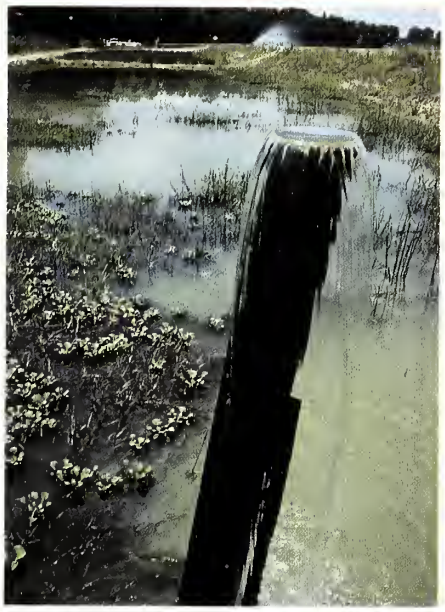
Behind the dam of a 4-acre catfish pond, Roberts constructed a 1-acre wetland site. He split the acre and installed two complete filter systems. Gravity-fed inlet risers are at both ends; two pumps, which spray filtered water back into the pond, meet in the middle.

In his wetland, Roberts planted torpedograss, maidencane, giant smartweed, and waterhyacinth. They remove ammonia and phosphorus from the water.

All catfish ponds need a freshwater flow to prevent ammonia toxicity. Ideally, water takes 36 hours to flow through the systems, and the pond is "turned over" monthly. Flow is varied depending on total ammonia in the water at

Pond water slowly filters through constructed wetland on Truman Roberts' catfish farm near Hattiesburg, Miss. Plants remove ammonia and other nutrients from water. (Photo by Art Greenberg.)

A major education effort was started under the slogan, "Clover Creek, you have it all—let's keep it clean!"



Pond-bottom water enters wetland filter through a gravity-fed inlet riser. (Photo by Art Greenberg.)

the inlet versus the sprayer. Plants filter and take up nutrients, grow larger, and, in turn, use more nutrients.

"After the 'closed' filtering system was operating just a few months, it was easy to smell the difference," said Gil Ray, SCS district conservationist in Hattiesburg. "Water entering the filter from the bottom of the pond lacked that 'odor' that makes you wrinkle up your nose."

Wetland plants constantly purify as they filter the pond water. This improves water quality and has allowed Roberts to stock his pond with 10,000 fingerlings per surface acre, versus the conventional 7,000 rate.

Constructing a wetland filter and recycling the water cost Roberts $15,000 (including $9,000 for gravel, which was optional). The alternative would have been a 1,000-foot-deep well costing more than $20,000.

Well water would be high in sulfur and would cost more than twice as much to pump, compared to recirculating water in the filter system. As water sprays back into the pond, it picks up oxygen that eliminates the need for aerators—something catfish farmers who pump ground water have to install and run.

"I'm doing it all in one motion," says Roberts, who has 60 acres of catfish water and plans to build four more wetland filters.

As Roberts lowered his water costs and kept ammonia levels low, other benefits have become evident. The wetland filter:

- Improves water quality through reduced turbidity, improved oxygenation, and suppression of algae bloom.
- Increases fish production and improves fish flavor.
- Reduces disease.
- Increases wildlife habitat.
- Saves ground water, money, and energy.

"Water quality and quantity are significant concerns to a large segment of the American people," said L. P. "Pete" Heard, SCS State conservationist in Mississippi.

"The University of Southern Mississippi is monitoring and analyzing these catfish pond wetland filters as one solution to improving the quality of water entering the Gulf of Mexico."

Art Greenberg, regional information officer, South National Technical Center, SCS, Fort Worth, Tex.

Clover Creek Once Again 'Fisherman's Dream'

COOL CLEAR water tumbling over rocks into a gently curling eddy is a sight to quicken the heartbeat of the ardent trout fisherman. Clover Creek in Blair County, Pa., fits this idyllic description, thanks to the efforts of the Soil Conservation Service and farmers and sportsmen in the Blair County Conservation District.

In 1983, SCS began a 10-year, $1.3 million project to improve water quality in 23-mile Clover Creek, which was described by some in years past as a "fisherman's dream." Its cool limestone water and clean gravel beds spawned a large population of native brown trout. Fishing was best in the middle 10 miles that ran through farmland.

In recent years, however, agriculture had intensified in the drainage area, and 97 percent of the 135 farms in the valley were dairy farms. Nutrients and soil erosion began to take a toll on the quality of the stream and its fish population. When increasing amounts of sediment covered the gravel beds, the natural spawning of brown trout in the stream ended.

Finally, the number of trout decreased dramatically in the farmland portion. Fishing was limited

Ed Biddle (red jacket) and Larry Parvin, SCS district conservationist, review Clover Creek streambank protection provided by rocks grouped along shoreline of Biddle's property. (Photo by Sylvia Rainford.)

to following the stocking trucks and 'put-and-take' fishing, which the sport fishermen did not enjoy.

Through the Watershed Protection Program (PL-566), the cleanup of Clover Creek was begun. A major education effort was started under the slogan, "Clover Creek, you have it all — let's keep it clean!" The conservation district hired Elaine Dell, a graduate agricultural engineer and dairy farmer, to visit each farmer and explain how techniques to keep soil and nutrients on the farm would improve their operation and also help bring back Clover Creek's natural fishery.

During the program's first year, Phillip Pheasant and Richard Eastep let their farms be used for field days and demonstrations of how the program worked. Under the program, farmers received up to 75 percent cost-sharing if they installed and used approved soil conservation and nutrient-management practices. So far, $848,000 has been obligated for the purpose; more than 50 farmers have signed agreements.

Problems of excessive runoff and streambank erosion led Ed Biddle to become one of the early participants in the program. Biddle, a dairy farmer and member of the Blair County Planning Commission, has four farms covering 500 acres along 1 mile of Clover Creek.

"I used to have ditches running through my fields," said Biddle. "You can't see any ditches now." Biddle also cited the economic benefits, such as no longer having to spread manure daily and less need for fertilizer.

Jim Mays, assistant State conservationist, believes that the collective efforts of farmers and the community have made the Clover Creek program successful. Mays reported that Clover Creek has the highest participation rate of any land-treatment project in the State.

The Pennsylvania Fish Commission maintains three monitoring stations on Clover Creek. Monitoring results show reductions in nutrient and sediment levels under the program. There also is a marked increase in trout numbers, according to the Commission stream census.

David Spotts, fisheries biologist for the Commission, believes the full effects of the changes in land treatment are yet to be seen. Spotts predicts continued improvement in stream quality.

Local Trout Unlimited member Richard Tate praises the progress made. "Erosion is definitely less," stated Tate. "The spawning beds are cleaner and as a result the wild trout are back."

District conservationist Larry Parvin said he knows that conditions are improving in Clover Creek because brown trout have returned to the farmland portion of Clover Creek and are reproducing naturally, and there are young brown trout in the stream's pools through the farmland. And lastly, "the fishing is great!"

Sylvia Rainford, public affairs specialist, SCS, Harrisburg, Pa., and **Frederick Bubb**, regional information officer, Northeast National Technical Center, SCS, Chester, Pa.

"A multiple-rating matrix containing any number of pesticides and soils is available."

NPURG Evaluates Pesticide Effects

A MICROCOMPUTER-based program developed in New England may have national applicability in helping to preserve water quality.

NPURG is the **N**ew England **P**esticide/Soils Database and **U**ser Decision Support System for the **R**isk Assessment of **G**round and Surface Water Contamination.

"Soil Conservation Service and Cooperative Extension System field staffs may use this pesticide/soil data base information delivery system to select a pesticide, a soil type, and a management practice, then obtain a relative screening," said Don Goss, SCS research soil scientist in Forth Worth, Tex. Goss developed national algorithms which are used in NPURG.

SCS in Massachusetts and the University of Massachusetts Cooperative Extension created NPURG. They were supported by SCS national headquarters, USDA Extension Service, SCS and Cooperative Extension staffs in the remaining New England States, and the SCS National Water Quality Development Staff.

NPURG includes physical and chemical properties of about 250 pesticides from the USDA pesticide characteristics data bases, and soils information from participating States' SCS soil interpretation records.

"A multiple-rating matrix containing any number of pesticides and soils is available," said Jeffrey Jenkins, Cooperative Extension pesticide coordinator (and NPURG's principal investigator) in Amherst, Mass.

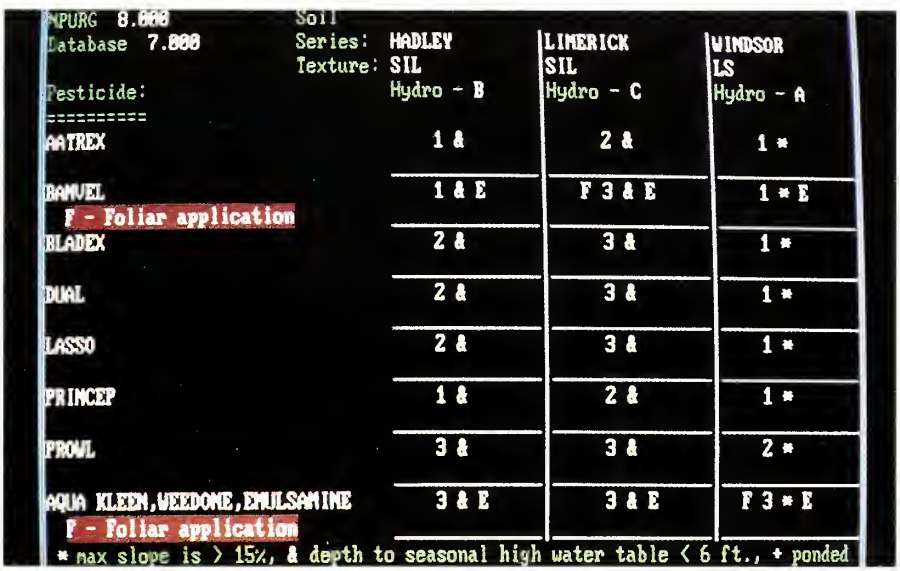
"The matrix, including farm, field, and crop information, can be printed out for documentation," said Joe Bagdon, SCS soil conservationist (and NPURG's project coordinator) in Amherst. "Also available is a printout of the soil and pesticide parameters used in the analysis."

"The user can input field-specific values to provide a more accurate rating," added Bagdon. "This information can be stored for later use. NPURG also contains information explaining variables and a risk-analysis procedure."

A companion SCS study, the New England Risk Assessment Project, is underway to more specifically and locally define effects of climate, management system, and nitrogen application.

Although NPURG was developed for New England-area application, it is being tested in other States.

Fred Suffian, water resources coordinator, SCS, Amherst, Mass.



In NPURG's multiple-rating matrix that evaluates pesticide and soil interactions, alternative pesticides are screened by soil type to evaluate potential impacts on water quality. (SCS photo.)

Water Quality at Home

Extension Targets Rural Homeowners

"YOU ARE responsible for the quality of water that comes from your well." That's the message that Cooperative Extension System agents throughout the country are taking to farmers, ranchers, and rural homeowners. "If you don't monitor it for safety, no one else will."

Extension agents are educating farmers, ranchers, and rural homeowners through a water quality program stressing the importance of drinking water supplies and how to assess drinking water quality.

Ground water sources provide about 50 percent of the drinking water in the United States. In rural areas, ground water provides 95 percent of the drinking water. To allay recent public concern about contamination, Extension began awareness programs dealing with the quality of rural drinking water supplies.

By mid-1990, Extension reported 45 States with active awareness programs. Most States have publications, fact sheets, and videos dealing with testing. And they have information on the health effects of water contaminants, how and where to have tests done, and water treatment methods. (See your local Extension agent for more information.)

At a Cooperative Extension System youth camp where natural resource appreciation is taught, this youngster collects surface water to use in sample testing. Water quality and quantity awareness are among Extension's educational efforts. (Cooperative Extension System photo.)

Cooperative Extension incorporates all the traditional methods of teaching in order to help homeowners become more knowledgeable about their drinking water. And the agency is adapting newer, more creative ways of informing the public.

For example, a Water Tasting Survey is held in New York each year. After county and regional competitions, finalists advance to the Best Tasting Water In New York competition, held annually at the New York State Fair.

Kansas, Idaho, Illinois, and Michigan have published newspaper tabloids for consumers addressing water quality concerns.

County Extension agents and State specialists hold workshops, clinics, and tours to answer questions and concerns that rural homeowners have about water quality and drinking water.

Extension agents set up water quality exhibits at malls, fairs, and other gatherings and provide free literature. In Indiana, a water qual-

ity flow model visually shows how ground water can become contaminated.

In Nebraska, many schools participate in the Water Riches program that covers ground water pollution, the water cycle, and conservation methods.

Many States have incorporated water quality curricula into youth camp activities to help youngsters learn ways to keep drinking water supplies safe.

Cooperative Extension has joined with other public and private agencies and organizations, including the Soil Conservation Service, in recognizing and celebrating National Drinking Water Week. Held annually in early May, this event allows Extension and others to help people to better understand water as a valuable resource.

National Drinking Water Week information packets include news releases, fact sheets, tips, clip art, and a proclamation and are mailed to over 3,000 county Extension offices nationwide. Most materials have anytime-applicability, and Extension staffs and others use them to keep the water quality topic in the forefront throughout the year.

The Cooperative Extension System is committed to helping rural homeowners stay informed about the water quality issue, and to making them aware that the quality of their drinking water is the responsibility of every rural homeowner.

Cathy Burwell, agent intern, Cooperative Extension System, Washington, D.C.

Self-Help Checklist

Water Quality Self-Help Checklist is a useful, thought-provoking 15-page pamphlet to help rural landowners analyze their water supplies and farming operations.

Originally produced in 1987 by the American Farm Bureau Federation (AFBF), the November 1989 fourth edition is cosponsored by 50 organizations including nine State conservation district associations and the National Association of Conservation Districts.

Landowners fill out the checklist themselves. They should review and update the information yearly. The checklist can guide landowners in reducing or preventing pollution in their farming activities.

The checklist includes (1) basic information on water supplies, climate, and soils; (2) sources of potential pollution of ground water and of drinking water supplies; (3) off-site assessment; (4) fertilizer checklist; (5,6, and 7) storage, handling, and application of agricultural chemicals; (8) taking a water sample; (9) recommended individual actions, and (10) suggested local activities.

Buy the checklist from AFBF, NER Division, 225 Touhy Ave., Park Ridge, IL 60068; (312) 399-5700.

Cooperative Well-Testing Program Expands

A WELL-TESTING program that reached 17,000 residents in 80 of Ohio's 88 counties is now being offered in other States under American Farm Bureau Federation sponsorship.

The cooperative testing program was developed in 1987 by the Water Quality Laboratory (WQL) of Heidelberg College. It links private well testing with local data base development. Organizations such as conservation districts, Cooperative Extension, and Farm Bureau sponsor countywide sampling programs.

For $12, the WQL analyzes samples for nitrate, nitrite, ammonia, chloride, sulfate, conductivity, silica, and phosphorus. Screen tests are also available for several herbicides.

Individuals receive analytical results for their wells, and sponsoring organizations receive a summary and map showing county results.

Information about the well testing program is available from the WQL director, Heidelberg College, Tiffin, Ohio 44883.

David B. Baker, Water Quality Laboratory director, Heidelberg College, Tiffin, Ohio

Hydrologic Units Benefit

Godfrey Creek Watershed Assisted

THE SOIL Conservation Service's Bozeman, Mont., field office is assisting land users in the Godfrey Creek watershed to improve its water quality.

Godfrey Creek, a spring-fed stream near Churchill, Mont., was 1 of 37 watersheds nationwide chosen for inclusion under the President's 1990 Water Quality Initiative. Godfrey Creek is a 3- to 5-year project.

In 1989, at the request of the Gallatin Conservation District, SCS evaluated water quality resources and the degree of health of riparian areas, analyzed public concerns, and developed treatment techniques for degraded areas. The resource planning stage that involves field-by-field planning began in March 1990.

Of this stage, says Gordon Hill, SCS district conservationist in Bozeman, "Our goal is to help each operator come up with an array of site-specific practice alternatives. They can then choose a solution that works best for their own operation."

The U.S. Department of Agriculture's SCS, Extension Service, and Agricultural Stabilization and Conservation Service (ASCS), as well as Montana State University (MSU), are working together to help participating land users implement their chosen alternatives.

According to Gene Surber, Gallatin County agent, the MSU Extension Service will be able "to provide facts and figures to operators based on current research, and to identify any additional research needs." He noted, "We will also help each operator evaluate the economics of various conservation practice installations and maintenance costs."

The Montana Water Quality Bureau has received special funds to help landowners apply practices that can save soil and water resources. The funds are available from the Environmental Protection Agency, through Section 319 of the Clean Water Act, to finance water quality demonstration projects.

Agricultural Conservation Program funds, administered by ASCS, also are available to help individual farmers finance conservation measures.

Bob Davis, former District board chairman and Bozeman farmer, expresses the District's opinion of the Godfrey Creek project: "This is a good opportunity for those of us in the agricultural community to demonstrate the effectiveness of a voluntary approach to meeting rural, nonpoint source water quality needs."

Montana's Godfrey Creek flows through dry cow and heifer confinement lots. Milk cows also roam through the area. Possible treatments are piping, diversion, filter strips, and stockwater developments to provide off-channel water facilities. Godfrey Creek was 1 of 37 watersheds nationwide selected for the President's 1990 Water Quality Initiative. (Photo by Tom Pick.)

Tom Pick, soil conservationist, SCS, Bozeman, Mont.

"We are impressed with the attitude of farmers in the Sand Mountain-Lake Guntersville water quality project..."

Innovations Clean Streams

George LaMunyon, left, shows poultry waste lagoon that he will use as a water supply for vegetable irrigation to Jerry Wisener, SCS district conservationist for De Kalb County, Ala. (Photo by Morris Gillespie.)

"POULTRY production is the lifeblood on the mountain," said George LaMunyon, who owns 60,000 laying hens on Sand Mountain in De Kalb County, Ala. "And we must not let the waste ruin the beauty and quality of living we enjoy here."

Sand Mountain-Lake Guntersville, Ala., was 1 of 37 watersheds nationwide selected for inclusion under the President's 1990 Water Quality Initiative. About $1.5 million in Agricultural Conservation Program funds have been used in the past 3 years to establish and implement some 120 long-term agreements with farmers in the area.

LaMunyon is trying to apply to the soil only the amount of poultry waste nutrients that plants can use. "It's the excess nutrients that pollute ground and surface water," he noted.

LaMunyon's efforts may draw attention, as he is the chairman of the Sand Mountain-Lake Guntersville Watershed Conservancy District. Also making innovations to improve water quality and quantity is farmer David Johnson, chairman of the De Kalb County Soil and Water Conservation District.

To deal with the waste products from his hens, LaMunyon is starting a demonstration project to irrigate vegetables on his land with water from the poultry waste lagoon. The waste water, laden with nutrients, will flow by gravity to the furrows. Excess water not used by the vegetables will be filtered by strips of grass at the ends of the rows.

LaMunyon will plant grasses, including tall fescue, bermudagrasses (tifton 44 and 78), brunswickgrass, giant cutgrass, eastern gammagrass, Alamo switchgrass, and smooth cordgrass. Vegetables such as sweet corn, collards, and squash will be grown on a 3-acre plot. LaMunyon plans to market the vegetables locally and believes the market for the produce will expand in time.

As LaMunyon said, "We are searching for ways to use animal waste and make it profitable. My farm demonstration of innovative technology will provide valuable information." He hopes that with use of the excess water from his lagoon system, fertilizer costs will be lower on the 3 acres.

David Johnson's innovations include plans to use water from the hog waste lagoon system to irrigate fescue for a cattle pasture. Installed 3 feet underground, 3-inch PVC pipe will carry the nutrient-laden lagoon water to irrigation sprinklers. The water will serve two paddocks at a time.

"I believe I can make money with grass-produced cattle," said Johnson. "By using the waste from my hog operation for fertilizer, I'm saving money and preventing a water pollution problem.

"We farmers are going to clean up our own problems, and we will do our share of cleaning up the streams and lakes."

Johnson hopes to expand his hog operation. Farrowing houses and lagoons will be located in fields where the waste water can be used.

"We are impressed with the attitude of farmers in the Sand Mountain-Lake Guntersville water quality project for finding and installing ways to improve and protect water quality in the area," noted Ernest Todd, SCS State conservationist.

Morris Gillespie, public affairs specialist, SCS, Auburn, Ala.

Improving Irrigation

Single Gate Replaces 100 Siphons In Eloy

Chris Haynes, SCS district conservationist at Casa Grande, above, checks results of high-flow irrigation technology used on Henry Lopez' farm in central Arizona. Haynes and Lopez, left, view "traditional" irrigation that uses hundreds of siphon hoses to accomplish what one turnout gate structure will do in the same time. (SCS photos.)

"MY NEW irrigation system allows me to put on 20 to 25 percent less water each time I irrigate," said Eloy, Ariz., cotton farmer Henry Lopez. "Instead of running 100 siphon tubes for 24 hours, I open a single turnout gate and flood the same area in 5 hours or less."

Lopez was one of the first producers to receive Soil Conservation Service technical and financial assistance available through the Eloy Water Conservation Project that has started to revitalize irrigated agriculture in central Arizona.

"Water costs make up as much as 30 percent of their annual cotton crop budget," said Chris Haynes, SCS district conservationist in Casa Grande, Ariz. "Our farmers need to attain high irrigation efficiencies to stay in business."

In this desert farming community, summer temperatures top 100°F for weeks at a time. Annual rainfall is a scant 8 inches but usually occurs when the 90,000 acres of crops cannot take advantage of it. Irrigation is a necessity.

Historically, farmers have irrigated with ground water pumped from farm wells. Since 1945, the water table in the Eloy subbasin has dropped 200 to 300 feet. Some wells have to pump water that's over 1,000 feet deep.

Authorized under the Watershed Protection Program (PL-566), the Eloy Water Conservation Project helps farmers begin using high-flow irrigation technology on their cropland. The Eloy Natural Resource Conservation District worked with SCS and the Central Arizona Irrigation District on this new conservation program for local farmers.

Using long-term agreements, SCS helps land users evaluate management alternatives that can produce substantial water savings. On the average farm, such conservation practices as land leveling, ditch lining, and high-flow irrigation turnouts can reduce irrigating by about 1.2 acre-feet per acre per year.

"Farmers here need a program like this to help them with their water conservation problems," said Lopez, who also expects to reduce labor costs and improve crop yields by irrigating more uniformly on his 600-acre farm.

The Eloy project is helping local farmers save water and save water costs by using the latest surface-irrigation technologies. The result is an revitalized agricultural livelihood throughout central Arizona.

Ralph Ware, soil conservationist, SCS, Casa Grande, Ariz.

"The faster flow, with less infiltration, over previously wetted furrow sections makes the concept of surge irrigation work."

New Mexico Improves Its Surge Irrigation

"SURGE IRRIGATION—with these new valves and control boxes—cut my watering time by one-third," said farmer David McSherry of Deming, N.M. "It's saving me 30 percent in water, energy, and labor costs."

The Soil Conservation Service set up automatic surge valves and programmable, solar-powered control boxes on McSherry's farm in 1989 to show Hidalgo County and Luna County farmers this new irrigation technique.

"A week later, after seeing the results, McSherry bought three surge valves and two control boxes to help irrigate his 360 acres of cotton, chili, and corn," said John Meetze, SCS soil conservationist in Deming. "Now he tells other farmers about his improved efficiency."

In conventional irrigation, water flows from the irrigation valve through gated pipe into all furrows—all at once. The flow continues until water reaches the far end of the furrows, sometimes a quarter-mile away.

Surge irrigation improves water delivery efficiency. The surge valve, mounted atop the irrigation valve, regulates water delivery. Programmed microchips in the control box limit flow time and trigger the surge valve to change flow direction.

The first surge travels down furrows to the left of the valve. Water percolates into the first section of furrow and partially seals the soil surface. The next surge travels right. Water percolates, then partially seals the soil surface. The third surge returns to the left, flows faster over the partially sealed soil surface, and irrigates the next furrow section.

"The faster flow, with less infiltration, over previously wetted furrow sections makes the concept of surge irrigation work," said Meetze. "Water spreads more uniformly along the furrows."

Previously, it took water 20 hours to reach the lower end of McSherry's furrows. By then, the upper end of each furrow was saturated far below the root zone. Surge irrigation cut his watering time by one-third.

"Overwatering wastes precious irrigation water," said Dick Bowen, SCS soil conservationist. "Fertilizers can leach out beyond the plants' root zone, and potentially seep into the ground water."

Bowen and Meetze are part of the SCS Hidalgo y Luna River Basin Team. They study basin irrigation conditions and propose ways to improve farming through increased irrigation efficiency and to boost the rural economy.

Bobby Hannah, SCS district conservationist in Deming, said that since the early 1980's, over 40 percent of the irrigated acres have been taken out of production, primarily due to rising water costs.

"If we can raise production 10 percent using new technologies like surge, tensiometers, and infrared guns, $2.2 million may be added to the rural economy," said Ray Margo, Jr., SCS State conservationist for New Mexico.

"And modernized surge irrigation will improve water quality and quantity in southwestern New Mexico."

John Meetze, left, SCS district conservationist in Deming, N.M., and conservation farmer David McSherry discuss finer points of improved surge irrigation technology on McSherry's irrigated cropland. (Photo by Jo E. Schilling.)

Jo E. Schilling, public affairs specialist, SCS, Rio Rancho, N.M.

Mizushima and over 2,000 other landowners cooperated with SCS by providing information on their irrigation systems and practices.

SCS Helps To Reduce Salt Runoff

WHEN TRUCK farmer Howard Mizushima's ancestors started farming in Grand Valley, Colo., close to a hundred years ago, little thought was given to the Mancos Shale formation beneath their fields.

"Today, however, our biggest concern is deep percolation through the shale," said Emery Johnson, district conservationist for the Soil Conservation Service in Grand Junction, Colo.

Percolation of ground water over and through shale picks up high concentrations of salt, which are transported to the Colorado River through wasteways, ditches, and by ground water. This salt load causes millions of dollars in damage and endangers the water quality and quantity for 18 million people.

Mizushima and most of the farmers in Grand Valley depend on irrigation to raise their crops, since precipitation is about 8 inches a year. Clean water for irrigation is plentiful from the Colorado River as its flow enters the valley from the southeast.

However, years of careless management have led to over-irrigation. The excess water leaches salts from the shale formation and carries them into the Colorado as the river exits the valley into Utah.

Early studies of the problem led to enactment of the "Colorado River Basin Salinity Control Act." Then the U.S. Department of Agriculture, the U.S. Department of the Interior, and the U.S. Environmental Protection Agency worked together to develop a salinity-control plan.

SCS began working with landowners to improve systems and to reduce runoff and the leaching of salts. Mizushima and over 2,000 other landowners cooperated with SCS by providing information on their irrigation systems and practices.

Over the past 10 years, more than 15 computerized irrigation monitoring and evaluation programs were developed to gather data on weather, soil moisture balance, crop water use, and other factors. With this data collected, SCS developed new and more efficient systems of irrigation.

The drip system reduces lateral seepage and deep percolation. The surge system irrigates through a series of ports from concrete ditches. The cablegation uses gated PVC pipe; through it passes a double-diaphragm plug that forces water out the gates. Most feeder and runoff ditches in the valley have been lined with concrete to minimize seepage.

Salts entering the Colorado River have been reduced by approximately 38,000 tons a year, according to Johnson.

Mizushima has nothing but praise for cablegation, the gated-pipe irrigated system SCS helped him develop. "It has cut the time it takes me to tend my irrigated fields in half," he said, "and time is money."

Jerry Schwien, public affairs specialist, SCS, Denver, Colo., and **John Plain**, public affairs specialist, SCS, Sacramento, Calif.

Two-State Border Lake Improved

BIG STONE LAKE—a favorite fishing and recreation area—has had the attention of two States for the past decade. Minnesota and South Dakota have worked to improve the water quality of the lake, which straddles their common border.

In the summer of 1979, most of the 19.3-square-mile lake was covered with an algal bloom and emergent aquatic growth. Beaches were closed, and fishing and boating declined.

However, local citizens rallied to form "Citizens for Big Stone Lake," which was the beginning of the Big Stone Lake Restoration Project, an Environmental Protection Agency Clean Lakes project. The Soil Conservation Service has taken an active part in the project, assisting land users in applying best management practices to reduce the flow into surface waters of three major water quality pollutants—sediment, nutrients, and pesticides.

Local people of both States worked to implement a plan to enhance the lake's water quality. Several steps have been taken:

- Communities within the three watersheds that feed Big Stone Lake, including Browns Valley,

. . . local citizens rallied to form "Citizens for Big Stone Lake," which was the beginning of the Big Stone Lake Restoration Project . . .

Water levels within this wetland in Big Stone County, Minn., can be regulated by a control structure. (Photo by Michael Price.)

Minn., and Sisseton and Milbank, S. Dak., improved their waste water treatment plants.

- A diversion was built on the North Fork of the Whetstone River in South Dakota to collect debris and divert other upstream pollutants before they entered the lake.
- An outlet-control structure was built in the Meadowbrook watershed, one of the lake's three major watersheds. Under normal conditions, it will hold back a depth of 30 inches of water covering about 60 acres. The structure helps provide cleaner water, flood control, and more wildlife habitat.
- Some livestock producers and an operator who raises about 45,000 geese established holding ponds and evaporation systems for animal waste.
- Specific areas were targeted for intensive application of best management practices. Cost-sharing up to 85 percent is helping land users incorporate animal-waste management systems into dairy and livestock operations.

"I like to fish and we need clean streams," explained dairy farmer Maynard Anderson of Sisseton, S. Dak. Anderson found that his new system was laborsaving, eliminated the need for commercial fertilizer, and improved his feedlot.

Of 17,000 acres of agricultural land in the Meadowbrook watershed, about 2,500 acres are enrolled in the U.S. Department of Agriculture's Conservation Reserve Program and Minnesota's Waterbank Program. Wetlands are being preserved or restored through these programs.

Pheasants Forever, Chapter 43, in Big Stone County, Minn., contributes to wildlife habitat restoration as a part of the project. Monte Matheson, former president of the chapter, is now an SCS Earth Team volunteer.

Matheson helps SCS; the Big Stone, Minn., Soil and Water Conservation District; and the Minnesota Department of Natural Resources improve habitat for pheasant and other upland game.

Other organizations cooperating on the restoration project are Grant County and Roberts County (S. Dak.) conservation districts, South Dakota Department of Natural Resources, Upper Minnesota River Watershed District, Minnesota Pollution Control Agency, Nature Conservancy, the City of Ortonville, and Big Stone County, Minn.

Michael Price, public affairs specialist, SCS, St. Paul, Minn., and **Joyce Watkins**, public affairs specialist, SCS, Huron, S. Dak.

A strong information program was launched that featured demonstration plots of various tillage methods and fertilizer rates on hilly land.

Clean Water Program Cuts Phosphorus In the Saline

SINCE 1981, Michigan's Rural Clean Water Program has reduced average phosphorus levels by 30 percent in the Saline River watershed, according to University of Michigan researchers.

Although erosion-control structures, grassed waterways, and fertilizer management were important, conservation tillage and animal manure management were the most widely used management practices.

The Saline Valley watershed is one of 20 Soil Conservation Service Rural Clean Water Projects in the United States to clean up rural waters while enhancing the rural economy. On-site technical help and up to 75 percent cost-sharing were key factors in the success of the Saline project.

Initially, animal manure systems were needed at 24 locations in the Saline Valley to control pollution from dairy and hog operations. Dairy operator Earl Horning became the first farmer to install a manure-handling system. Now, 23 of the 24 systems are fully operational.

Soils in the Saline Valley are mostly heavy clay loams rich in phosphorus. Therefore, it was important to reduce soil erosion and manage fertilizer application.

A strong information program was launched that featured demonstration plots of various tillage methods and fertilizer rates on the hilly land. Many farmers have now adopted no-till on highly erodible fields and are managing their fertility programs to match crop needs.

In 1981, 8- to 10-foot-deep gullies extended through two or more farms in parts of the watershed. Program assistance allowed farmers to transform these gullies into grassed waterways with drop-inlet structures for outlets. Over 60 acres of gullies have been corrected to date.

All improvements required more money than most farmers could afford, and cost-sharing was an important part of the program.

Conservationists touring the Saline Valley after heavy rains in May 1989 observed how management practices had improved water quality. They compared two subwatersheds—one with limited conservation and the other with good conservation protection.

In the 60-acre subwatershed of clean-tilled, recently planted soybean and corn fields, the group observed runoff clouded with sediment and flowing 6 inches deep in the waterway. Signs of sheet and rill erosion were obvious. Later estimates placed erosion at 12 to 15 tons per acre during the storm.

In the 100-acre subwatershed with hay, no-till corn, and other conservation practices, just a trickle of water was flowing in the waterway. And, the trickle was crystal clear.

The contrast was striking. The protected fields kept their soil, pesticides, and fertilizer in place and did not contribute pollutants to the Saline River.

Gary Rinkenberger, district conservationist, SCS, Ann Arbor, Mich., and **Roger Howell,** public affairs specialist, SCS, East Lansing, Mich.

Manure storage facilities on Earl Horning's dairy farm in Michigan's Saline Valley keep polluted runoff out of Pleasant Lake. Horning uses runoff and manure to irrigate and fertilize fields quite distant from lake. (Photo by Roger Howell.)

Perhaps as important as the cleanup itself were the statistical methods and monitoring procedures developed to accurately assess the progress of the cleanup.

mPHRED and BARNY Help Clean Up The LaPlatte

A DECADE AGO, the LaPlatte River, near Shelburne, Vt., was targeted for priority cleanup under Vermont's Agricultural Water Quality Plan. Sediment and animal waste were major pollutants.

After 11 years of monitoring water quality changes resulting from land treatment in the LaPlatte watershed, the votes are in: overall, it is thumbs up for this cleanup project, the first land-treatment-only project authorized under the Watershed Protection Program (PL-566).

Four Soil Conservation Service statistical models, mPHRED, BARNY, MILK, and STACKS, helped track the cleanup progress.

SCS planned properly sized, vegetated filter strips that helped achieve reduced levels of bacteria, suspended solids, nitrogen, and phosphorus in the river. Recommended barnyard and manure management practices cut pollutant leakage and reduced phosphorus loads to surface water. Improved farming practices reduced sedimentation.

Overall goals listed for this $2.5 million project were reached: a 50-percent reduction of sediment loading from the LaPlatte into Shelburne Bay, and an 80-percent control of cropland and animal waste pollution.

Perhaps as important as the cleanup itself were the statistical methods and monitoring procedures developed to accurately assess the progress of the cleanup. SCS and the Winooski Natural Resources Conservation District collaborated on these with the Water Resources Research Center at the University of Vermont.

The LaPlatte, a 16-mile river encompassing 34,000 watershed acres, runs through portions of six towns and empties into Shelburne Bay on Lake Champlain. The area has about 50 major dairy farms, averaging 300 acres each; hay and corn are grown for silage.

Prior to 1979, the LaPlatte was considered one of the main agricultural polluters of Lake Champlain. Although cropland occupied only one-tenth of the watershed acreage, it generated most of the soil displacement because of continuous corn production, insufficient crop rotation, and less desirable tillage methods.

Monitoring stations in LaPlatte River watershed helped document 11 years of water quality improvement. The LaPlatte received priority cleanup under Vermont's Agricultural Water Quality Plan. (Photo by D. L. Drew.)

The Water Resources Research Center collected data from five automated stations monitoring water quality along the river and its

How To Succeed

With land-treatment-only cleanup in PL-566 projects

- Develop detailed, water-based land management plans using the best available data, models, and/or techniques.
- Develop an early information program for both long-term contracting and monitoring.
- Prioritize farms early in the project. Heavily involve the conservation district in this decision-making, based on a uniform prioritizing procedure.
- Provide enough experienced personnel to effectively carry out project activities. Develop an efficient and effective water quality plan for each landowner.
- Provide ample followup assistance to assure that landowners adopt prescribed levels of management.
- Provide before-project and midproject training on water quality, pollutant transport, contract administration, and design and installation of complex practices, as necessary.
- Continually assess project progress and problems, and revise and redirect as necessary.
- Keep the public informed.

"The SWCD was the tree trunk; every other agency was a branch. We have a real grassroots effort going here."

tributaries. Then the Center evaluated how conservation practices affected the transport of sediment and nutrients to Shelburne Bay.

Over the life of the project, SCS developed and refined four predictive and comparative nonpoint source models; their evaluations were compared with the monitoring data. The refined results provided estimates of phosphorus and sediment loads being transported from a field, a farm, and the watershed.

mPHRED, the **m**odified **Ph**osphorus **Red**uction model, estimates average annual erosion, sediment, and particulate phosphorus runoff from cropland, and estimates the average annual dissolved phosphorus runoff resulting from field-spread manure.

BARNY, the **B**arnyard **A**rea **R**unoff **N**utrient **Y**ield model, derives average total phosphorus losses from barnyards and estimates total phosphorus loads entering watercourses from these sources.

The **MILK** model derives average annual total phosphorus losses from milk house waste discharges and estimates total phosphorus loads entering watercourses from these milk houses.

The **STACKS** model derives average annual total phosphorus losses from manure piles and estimates their total phosphorus loads entering watercourses.

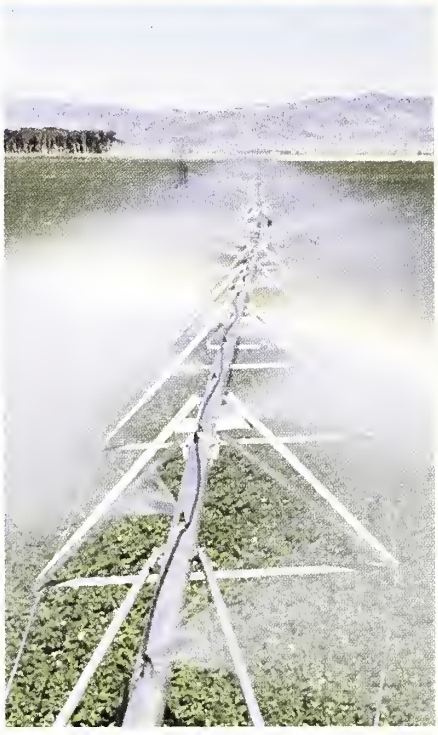
For the LaPlatte, these models also estimated differing results between alternative management practices. They prioritized farms needing treatment measures. And they tracked how well nonpoint source management practices were applied.

Public perception plays a role in the success of any project this large. Residents along the LaPlatte noticed a positive change in the river's clarity. The Shelburne Treatment Plant reported decreased turbidity of its receiving waters taken from Shelburne Bay.

Among the 40 farmers targeted for voluntary, long-term, cost-share agreements, all felt that they had contributed significantly to protecting water quality and that practices they had installed equated to money well spent.

The mPHRED, BARNY, MILK, and STACKS models were extremely useful in planning and tracking cleanup progress in Vermont's LaPlatte River, and they can be used in similar watersheds in New England.

Ann Dudas, public affairs specialist, and **Thomas Gould,** water resources specialist, SCS, Winooski, Vt., and **Donald Hipes,** district conservationist, SCS, Essex Junction, Vt.



Irrigation is widespread in Mason County, Ill., where speciality farming is a $30-to-$40-million-a-year business. (Photo by Keith VanDeVelde.)

Resource Planning Brings Dividends

FROM TOO MUCH water—in the case of flooding—to too little water—in the case of shrinking or contaminated supplies, water problems are of increasing concern to local communities.

In Illinois, a number of community leaders are using the strategy of resource planning by small watersheds, or hydrologic units, to identify water resource problems and find solutions to them. Farmers in Mason County, Ill., turned to the Mason County Soil and Water Conservation District (SWCD) for help in maintaining water quality and quantity.

Irrigation of crops and use of needed chemicals for crop nutrition and protection were concerns. The area's sandy soils allowed fertilizers and pesticides to leach rapidly downward to the shallow ground water. The 200-foot-deep

sand and gravel aquifer and the water table are located an average 10 to 20 feet below the surface.

Because the western part of Mason County has sandy soils and plentiful water, farmers there call it "the Imperial Valley of the Midwest." Specialty farming is a $30-to-40-million-per-year business in the county, where 40,000 acres of vegetables such as lima beans, cucumbers, peas, green beans, and popcorn are grown.

The Mason County SWCD used the Illinois Resource Planning Guidebook as a checklist to begin the resource planning process. As Keith VanDeVelde, district conservationist, Havana, Ill., put it, "The SWCD was the tree trunk; every other agency was a branch. We have a real grassroots effort going here."

The resource planning has grown into the Illinois River Sands Water Quality Project, one of 37 national watershed projects selected by the U.S. Department of Agriculture. Under the project, practices recommended to farmers include use of winter cover crops, integrated crop management, and backflow prevention devices on farm irrigation units.

Also suggested are sealing abandoned wells and removing underground fuel tanks. In addition to aiding ground water quality, some of the practices will reduce wind erosion of the sandy soils of Mason County.

Kay Kitchen-Maran, public affairs specialist, SCS, Champaign, Ill.

Earth Team Volunteer Honored

First they said a few words. Then they played a videotape of Wilson Scaling, then Chief of the Soil Conservation Service, giving a speech. So far it was a typical awards ceremony in SCS's Greenwood, Miss., field office.

But, Scaling wound up his speech by saying that SCS was presenting Earth Team volunteer Alice Teal with the videotape—and the videotape cassette recorder. It was an unusual and fitting recognition of an individual who has contributed more than 3,000 volunteer hours to SCS since January 1986.

Teal has myositis ossification, a disease which renders her entire body immobile except for the wrist and hands. With the help of special equipment, she answers the telephone, dials it, and takes written messages.

Before she began volunteering, the field office phone often went unanswered. The office clerk works part-time, and the staff spends much time in the field. Now the telephone switches over to Teal's home number when no one is going to be in the office.

Teal's volunteer assistance has improved the help that SCS and the Leflore County Soil and Water Conservation District can provide landowners. The district has received many compliments about her pleasant voice and her eagerness to be of assistance. She has gained a reputation for efficiency and responsibility.

In addition to the SCS award, Teal recently received the "Spirit of Mississippi" award from a local television station.

Teal says that the telephone is her only contact with the outside world, and she enjoys the opportunities she has to communicate with people. Now she'll be able to engage in another favorite pastime: watching movies on her new VCR.

Sarah Laurent, writer-editor, SCS, Washington, D.C.

Dale Garner, Jr., SCS district conservationist in LeFlore, Miss., presents Alice Teal with videotape and videotape cassette recorder for volunteering 3,000 hours in the Earth Team program. Teal has myositis ossification. (Photo by Becky McNair.)

Center Gives Water Quality Information

Water quality information has been flowing in and out of the Conservation Technology Information Center (CTIC) since the organization's inception 8 years ago. And the Soil Conservation Service has been actively working with CTIC to provide useful water quality information to the Nation.

"What makes CTIC different is the way we approach our information gathering and disseminating process," said John Becherer, CTIC executive director. "We're very pleased to provide a neutral ground where governmental agencies, agricultural industries, educational institutions, and farmers can come together to discuss such vital issues as the protection of our Nation's water quality."

Many governmental organizations actively participate in CTIC activities, but, according to Becherer, SCS is one of the agency pioneers. SCS provides an advisor and two liaisons, who serve as technical consultants to the CTIC staff.

CTIC also transforms technical information on water quality into information packages that are readily usable by its audience. For example, agency and university experts in nitrogen, phosphorus, and pesticide management provided information for a series of water quality fact sheets.

Single copies of the fact sheets and most other CTIC publications are available at no charge. CTIC's monthly newsletter, *Conservation Impact*, is available as a benefit of CTIC's $15 individual membership. For more information, write CTIC, 1220 Potter Drive, Room 170, West Lafayette, IN 47906-1334, or call 317-494-9555.

Vickie Tarvin, communications director, CTIC, West Lafayette, Ind.

Iowa Produces Water Quality Videotape

The State of Iowa is REAPing water quality benefits from the Resource Enhancement and Protection (REAP) Act. More than $200 million in State funding has been targeted over the next decade for natural resource improvements. Some of the funds went toward producing a six-part videotape, "Better Land, Better Water."

The video shows how to: (1) take a late-spring nitrogen test, (2) plug an abandoned well to prevent contamination of ground water, (3) plant a tree, (4) plan and plant a farmland windbreak, (5) establish grass filter strips along streams and lakes, and (6) establish grasses successfully for soil erosion control.

"Better Land, Better Water" is patterned after the Soil Conservation Service and National Association of Conservation Districts "how-to" videotape, "Conservation On Your Own," which gives step-by-step instructions on practices to farmers and ranchers.

This Iowa videotape was produced by the Iowa State University Cooperative Extension Service, the Iowa Department of Natural Resources, the Soil Conservation Division of the Iowa Department of Agriculture and Land Stewardship, the Iowa Association of Soil and Water Conservation Districts, and SCS. It is scheduled to be released in January 1991 and will be on loan free of charge. Copies available from local offices of these organizations.

Lynn Betts, public affairs specialist, SCS, Des Moines, Iowa

Tree planting is one of the topics featured in a six-part "How-to" video. (Photo by Lynn Betts.)

NEW in Print

Subsurface-Water Flow and Solute Transport: a federal glossary of selected terms

Issued by the U.S. Geological Survey, Department of the Interior

In this 38-page, August 1989 publication, 268 terms are defined, from "absorption" to "well injection." Where appropriate, terms may have additional, more specialized definitions. The five tables list parameters with associated symbols and units and show conversion charts.

This glossary of selected terms for saturated and unsaturated flow of contaminants in the subsurface will help communication between soil scientists, hydologists, and hydrogeologists.

Terms were selected from glossaries and reports of (1) ground water geology, hydraulics, and chemistry, (2) soil-water physics and chemistry, (3) contaminant transport, (4) unsaturated-zone hydrology, (5) chemistry and transport of solutes, and (6) ground water quality.

Plans are to periodically update the glossary. Request free single copies from the Office of Water Data Coordination, 417 National Center, U.S. Geological Survey, Reston, VA 22092.

The Science of Soil

"Soil is the basis of all life. We walk on it, grow our crops in it, pave it over for roads and airports, and, all too often, take it for granted. Teachers should realize, however, that soil has its place in the classroom and laboratory."

These are the lead sentences in a three-page article, "The Science of Soil," that Soil Conservation Service specialists wrote for the May 1990 issue of *Science Teacher,* published by the National Science Teachers Association (NSTA).

With a circulation of 27,000 and a readership of about 70,000, *Science Teacher* serves classroom teachers, curriculum specialists, and administrators in secondary science education across the United States and Canada.

The collaborative product of "The Science of Soil" explains soil properties, soil processes, weathering, clay translocation/accumulation, crystallization, soils under the microscope, and polarizing microscopes.

Eye catching indeed are the full-color cover and the black and white photographs of soil photomicrographs shot through a polarizing microscope at magnifications between 10 and 100 power. The section preparations are described to show teachers a new way to stimulate student interest in soil.

A page of laboratory activities on (1) moisture and organic matter in soil, (2) mineral materials in soil, (3) soil pH, and (4) how much space there is in a soil sample provides hands-on student exercises for teachers to use. Each exercise gives an objective, the materials needed, procedures, and an activity.

Single copies of the May 1990 issue, at $4.50, are available from *The Science Teacher,* NSTA, 1742 Connecticut Avenue NW., Washington, DC 20009, as long as supplies remain.

Coauthors are Hari Eswaran, Ted Kupelian, Tom Levermann, and David Yost. Additional information on soil photomicrographs is available from Eswaran or Yost, SCS, P.O. Box 2890, Washington, DC 20013-2890.

Two other articles in the May issue, "Here's Mud in Your Eye" and "Soil Arthropods," dealt with soil studies of invertebrates and arthropods.

New in Print is prepared by **Paul DuMont**, associate editor, *Soil & Water Conservation News.*

Soil scientists study mineral composition of undisturbed soil blocks at 10- to 100-power magnifications. Thin sections are photographed through polarizing microscopes. In this clay film, red bands are iron stains, white fields are quartz, white specks are uncoated clay, and black areas are open spaces. (SCS photo.)

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Soil Conservation Service
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Conservation Calendar

November	4	American Horticultural Society Meeting, Tucson, Ariz.
	7-9	"How Clean is Clean? Cleanup Criteria for Contaminated Soil and Groundwater," Air and Waste Management Association Meeting, Boston, Mass.
	11-13	National Association of State Universities and Land-Grant Colleges, Kansas City, Mo.
	26-29	Outlook '91: USDA Agriculture Outlook Conference, Washington, D.C.
December	2-5	America's Sea—A National Resource At Risk, New Orleans, La.
	3-7	AGU (American Geophysical Union) Fall 1990 Meeting, San Francisco, Calif.
	5-7	National Association of Government Communicators Annual Conference, Arlington, Va.
	9-10	American Farm Bureau Federation Board Meeting, Chicago, Ill.
	9-12	NACD's (National Association of Conservation Districts) Urban Conservation Symposium, Kansas City, Mo.
	17-18	Sixth International Symposium on Agricultural & Food Processing Wastes, American Society of Agricultural Engineers, Chicago, Ill.
January	6-10	American Farm Bureau Federation 72nd Annual Meeting, Phoenix, Ariz.
	13-17	National Turkey Federation Annual Convention, Orlando, Fla.
	20-22	National Cattlemen's Association Convention and Trade Show, Dallas, Tex.
February	16-23	National Future Farmers of America (FFA) Week
	20-21	Midwest Poultry Federation Convention, Minneapolis, Minn.
	22-23	Ag Energy Symposium, Malta, Mont.